

# Cumbernauld Academy Maths Department



## S3 Level 4/5 Revision Booklet

|   |  |  |   |
|---|--|--|---|
| <b>Learning Intention</b>   | I can simplify and carry out calculations using surds.                                   |  |   |
| <b>Success Criteria</b>   |  |  |   |
| • I know how to find the square, square root, cube or cube root of numbers.   | Evaluate $3^2$   | $\sqrt{49}$  | $10^3$ $\sqrt[3]{64}$                                       |
| • I can identify surds.   |  |  |   |
| • I know that $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ , $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ , $\sqrt{a} \times \sqrt{a} = a$ and $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ . |  |  |   |
| • I know how to fully simplify surds.   | Show that $\sqrt{75} = 5\sqrt{3}$  | Simplify $\sqrt{72}$   |   |
| • I can add and subtract surds.   | Simplify $2\sqrt{5} + 7\sqrt{5}$ , $\sqrt{75} - \sqrt{48}$ and $\sqrt{75} - \sqrt{27}$ . | Express $\sqrt{12} - \sqrt{3} + \sqrt{48}$ as a surd in its simplest form. |   |
| • I can multiply surds.   | Expand and simplify $\sqrt{3}(\sqrt{3} - 1)$   | $\sqrt{2}(3 - \sqrt{6})$   | $(2 + \sqrt{2})(3 + \sqrt{2})$ $(2\sqrt{5})(2\sqrt{5} - 1)$ |

|  |  |                    |  |
|--|--|--------------------|--|
| <b>Learning Intention</b>  | I can simplify and evaluate expressions using the laws of indices. |                    |  |
| <b>Success Criteria</b>  |  |                    |  |
| • I know that $3^4 = 3 \times 3 \times 3 \times 3$ and 3 is the base value and 4 is the index value. |  |                    |  |
| • I know that $a^m \times a^n = a^{m+n}$   | Simplify $x^4 \times x^5$  | $3x^7 \times 5x^2$ |  |
| • I know that $a^m \div a^n = a^{m-n}$   | Simplify $x^8 \div x^5$  | $x^2 \div x^{-3}$  |  |
| • I know that $(a^m)^n = a^{mn}$   | Simplify $(2a^3)^4$  |                    |  |

|  |                                 |                                 |             |  |  |  |
|--|---------------------------------|---------------------------------|-------------|--|--|--|
| • I know that $a^0 = 1$                  | Simplify                        | $5^0$                           | $(3ab^2)^0$ |  |  |  |
| • I can simplify expressions of the form | $\frac{x^5 \times x^4}{x^{-2}}$ | $6x^2 \times 2x^{-\frac{1}{3}}$ |             |  |  |  |

|   |   |  |  |  |  |  |
|---|---|--|--|--|--|--|
| <b>Learning Intention</b>   | I can carry out calculations using scientific notation. |  |  |  |  |  |
| <b>Success Criteria</b>   |   |  |  |  |  |  |
| • I can write large and small numbers in scientific notation.   | $1820000 = 1.82 \times 10^6$                            | $0.00049 = 4.9 \times 10^{-4}$             |  |  |  |  |
| • I can carry out calculations using scientific notation.   | Calculate   | $(1.2 \times 10^5) \times (9 \times 10^7)$ |  |  |  |  |
| • I can use my calculator to carry out calculations using values in scientific notation.<br>There are $5 \times 10^9$ red blood cells in 1 millilitre of blood. The average person has 5.5 litres of blood.<br>How many red blood cells does the average person have in their blood? Give your answer in scientific notation. |   |  |  |  |  |  |

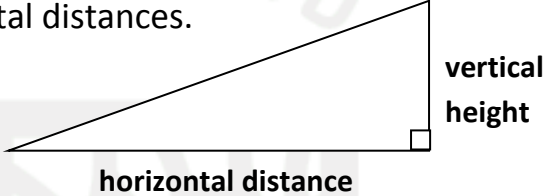




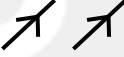
|   |   |                    |                         |  |  |  |
|---|---|--------------------|-------------------------|--|--|--|
| <b>Learning Intention</b>   | I can simplify algebraic expressions involving the expansion of brackets. |                    |                         |  |  |  |
| <b>Success Criteria</b>   |   |                    |                         |  |  |  |
| • I know how to expand a bracket and simplify:                            | $3 + 4(b - 2)$  | $4c - (c - 3)$     | $4(2t + 1) + 5(3t - 2)$ |  |  |  |
| • I know how to expand a bracket of the form:                             | $2t(3t + 1)$  | $7g(6 - g)$        |                         |  |  |  |
| • I know how to expand pairs of brackets with 2 linear expressions:       | $(x + 3)(x + 5)$  | $(4y + 1)(3y - 2)$ | $(3x - 4)^2$            |  |  |  |
| • I know how to expand brackets with a linear and a quadratic expression: | $(4y + 1)(3y^2 + 5y - 2)$   |                    |                         |  |  |  |

|  |  |   |   |
|--|--|---|---|
| <b>Learning Intention</b>  | I can factorise an algebraic expression. |   |   |
| <b>Success Criteria</b>  | 😊  | 😐 | 😞 |
| <ul style="list-style-type: none"> <li>I can factorise an expression by finding the Highest Common Factor (HCF).<br/>Factorise the following: <math>21 - 35x</math>      <math>8a^2b - 12ac</math></li> </ul>  |  |   |   |
| <ul style="list-style-type: none"> <li>I know how to factorise an expression using a difference of two squares.<br/>Factorise the following: <math>x^2 - y^2</math>      <math>t^2 - 36</math>      <math>9x^2 - y^2</math>      <math>64 - 49y^2</math></li> </ul>                        |  |   |   |
| <ul style="list-style-type: none"> <li>I know how to factorise an expression using a common factor and a difference of two squares.<br/>Factorise the following: <math>5x^2 - 20y^2</math></li> </ul>  |  |   |   |
| <ul style="list-style-type: none"> <li>I know that a trinomial expression is of the form <math>ax^2 + bx + c</math>.</li> </ul>  |  |   |   |
| <ul style="list-style-type: none"> <li>I know how to factorise a trinomial expression of the form <math>x^2 + bx + c</math>.<br/>Factorise the following: <math>x^2 + 6x + 8</math>      <math>x^2 - x - 6</math>      <math>x^2 + 5x - 6</math>      <math>x^2 - 5x - 6</math></li> </ul> |  |   |   |

|   |   |   |   |
|---|---|---|---|
| <b>Learning Intention</b>   | I can complete the square in a quadratic expression with unitary $x^2$ coefficient. |   |   |
| <b>Success Criteria</b>   | 😊   | 😐 | 😞 |
| <ul style="list-style-type: none"> <li>I know how to express <math>x^2 + bx + c</math> in the form <math>(x + p)^2 + q</math> where <math>p = b \div 2</math> and <math>q = c - p^2</math><br/>Express <math>x^2 + 6x - 2</math> and <math>x^2 - 8x + 4</math> in the form <math>(x + p)^2 + q</math>.</li> </ul> |   |   |   |

|                                       |  |                   |                       |  |
|---------------------------------------|--|-------------------|-----------------------|--|
| <b>Learning Intention</b>             | I can reduce an algebraic fraction to its simplest form. |                   |                       |  |
| <b>Success Criteria</b>               |  | 😊                 | 😐                     | 😞  |
| • I can simplify fractions.           | Simplify the following:                                  | $\frac{7}{21}$    | $\frac{27}{63}$       |  |
| • I can simplify algebraic fractions. | Simplify the following:                                  | $\frac{x^2}{x^5}$ | $\frac{10y^7}{15y^4}$ | $\frac{(y+2)(y-3)}{(y-3)(y-4)}$ $\frac{x^2-4}{2x+4}$ |

|   |  |                                    |                                      |                             |                                     |                                   |
|---|--|------------------------------------|--------------------------------------|-----------------------------|-------------------------------------|-----------------------------------|
| <b>Learning Intention</b>                             | I can carry out calculations with algebraic fractions. |                                    |                                      |                             |                                     |                                   |
| <b>Success Criteria</b>                               |  | 😊                                  | 😐                                    | 😞                           |                                     |                                   |
| • I can add, subtract, multiply and divide fractions. | Evaluate   | $3\frac{2}{5} + 1\frac{1}{3}$ ,    | $2\frac{3}{4} \times 1\frac{1}{5}$   | and                         | $2\frac{1}{3} \div 1\frac{3}{4}$ .  |                                   |
| • I can add and subtract algebraic fractions.         | Simplify the following:                                | $\frac{x}{2} - \frac{x}{3}$ ,      | $\frac{5}{x} + \frac{2}{y}$ ,        | $\frac{t}{x} - \frac{3}{y}$ | and                                 | $\frac{x+1}{2} + \frac{x-1}{3}$ . |
| • I can multiply and divide algebraic fractions.      | Simplify the following:                                | $\frac{t}{5} \times \frac{3}{y}$ , | $\frac{t}{15} \times \frac{25}{t^2}$ | and                         | $\frac{x}{7} \div \frac{x^3}{14}$ . |                                   |

| Learning Intention  | I can calculate the gradient of a straight line, given two points. |   |   |
|---|--|---|---|
| Success Criteria  | 😊  | 😐 | 😞 |
| <ul style="list-style-type: none"> <li>I can calculate the gradient of a line using vertical and horizontal distances.</li> </ul> $\text{Gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$    |  |   |   |
| <ul style="list-style-type: none"> <li>I can recognise lines with positive  and negative  gradients.</li> </ul>  |  |   |   |
| <ul style="list-style-type: none"> <li>I can recognise lines with zero  and undefined  gradients.</li> </ul>  |  |   |   |
| <ul style="list-style-type: none"> <li>I know that parallel lines have equal gradients. </li> </ul>   |  |   |   |
| <ul style="list-style-type: none"> <li>I know that the gradient formula is <math>m = \frac{y_2 - y_1}{x_2 - x_1}</math>.</li> </ul>   |  |   |   |
| <ul style="list-style-type: none"> <li>I know how to use the gradient formula.<br/>           Calculate the gradient of the line joining <math>A(1,-7)</math> and <math>B(4,3)</math>.<br/>           Calculate the gradient of the line joining <math>C(2,-3)</math> and <math>D(8,-3)</math>.<br/>           Calculate the gradient of the line joining <math>E(4,5)</math> and <math>F(4,3)</math>.</li> </ul> |  |   |   |

**Learning Intention** I can use and interpret straight line equations.

**Success Criteria**

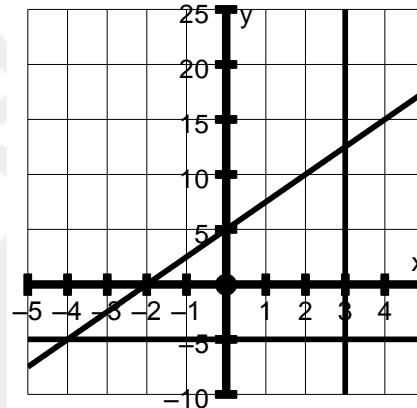


- I can use and interpret the straight line equation  $y = mx + c$ .

(1) Write down the gradient of the line  $y = 2x - 4$  and the coordinates of the point where it crosses the y-axis.

(2) Sketch the lines with equation  $y = -x + 3$ ,  $y = 2$  and  $x = -4$ .

(3) Find the equation of the straight lines shown in the diagram.



- I know that  $y - b = m(x - a)$  represents a straight line with gradient  $m$ , passing through the point  $(a, b)$ .




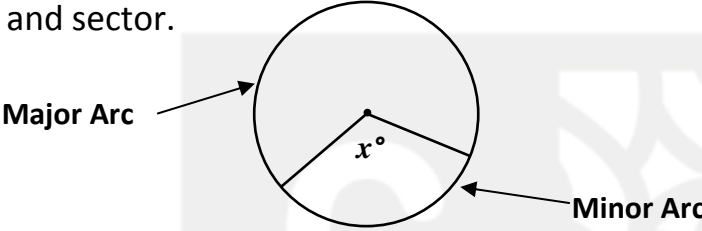
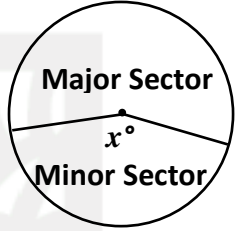
- I can determine the equation of a straight line using  $y - b = m(x - a)$ .

Find the equation of the straight lines which pass through the point:

(a)  $(1, 5)$  with a gradient of 2                      (b)  $(-4, 3)$  with a gradient of 5

- I can determine the equation of a straight line using two points which lie on the line.

Find the equation of the line joining  $A(-2, -8)$  and  $B(3, 2)$ .

|  |   |   |   |
|--|---|---|---|
| <b>Learning Intention</b> I can calculate the length of an arc and the area of a sector of a circle.   |   |   |   |
| <b>Success Criteria</b>  |  |  |  |
| <ul style="list-style-type: none"> <li>I can calculate the circumference and area of a circle using <math>C = \pi d</math> and <math>A = \pi r^2</math>.</li> </ul>  |   |   |   |
| <ul style="list-style-type: none"> <li>I know the meaning of arc and sector.</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> |   |   |   |
| <ul style="list-style-type: none"> <li>I know how to calculate the length of an arc using arc length = <math>\frac{x}{360} \times \pi d</math>.</li> </ul> <p>Calculate the length of the arc shown to 1 decimal place.</p>  |   |   |   |
| <ul style="list-style-type: none"> <li>I know how to calculate the area of a sector using sector area = <math>\frac{x}{360} \times \pi r^2</math>.</li> </ul> <p>Calculate the area of the sector of the circle shown to 1 significant figure.</p>   |   |   |   |
| <p>A school baseball field is in the shape of a sector of a circle as shown.</p> <p>Given that O is the centre of the circle, calculate:</p> <p>(a) the <b>perimeter</b> of the playing field to 2 decimal places.</p> <p>(b) the area of the playing field to 2 significant figures.</p>  |   |   |   |

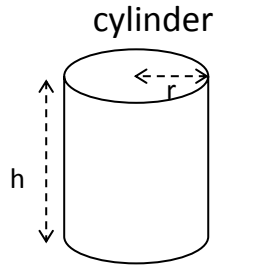


**Learning Intention**

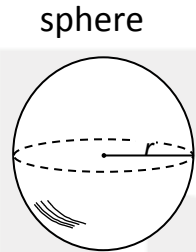
I can calculate the volume of a standard solid rounding my answer appropriately.

**Success Criteria**

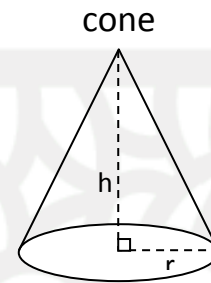
- I can calculate the volume of any solid given its formula.



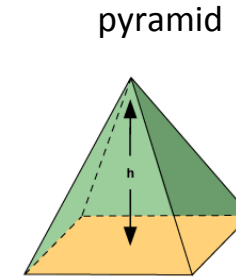
$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$

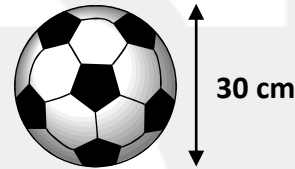


$$V = \frac{1}{3} \pi r^2 h$$



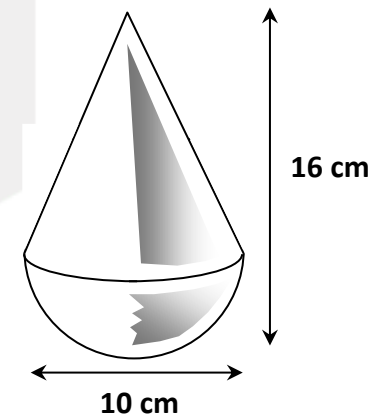
$$V = \frac{1}{3} Ah$$

The football has a diameter of 30 cm.  
Calculate its volume, take  $\pi = 3.14$ . (non-calculator example)



- I can solve problems rounding my final answer using significant figures.

A child's toy is in the shape of a hemisphere with a cone on top, as shown.  
The toy is 10 cm wide and 16 cm high. Calculate the volume of the toy.  
Give your answer correct to 2 significant figures.



|   |   |   |   |
|---|---|---|---|
| <b>Learning Intention</b>   | I can solve linear equations and inequations. |   |   |
| <b>Success Criteria</b>   | 😊   | 😐 | 😞 |
| <ul style="list-style-type: none"> <li>I can solve linear equations.<br/>Solve <math>3x + 5 = 17</math>      <math>8x - 11 = 5</math>      <math>5x - 1 = 2x + 23</math>      <math>7x + 11 = 4x - 19</math></li> </ul> |   |   |   |
| <ul style="list-style-type: none"> <li>I can solve equations involving brackets.      Solve <math>3(x - 5) = 21</math>      <math>5(x + 7) - 2(3x - 4) = 45</math></li> </ul>   |   |   |   |
| <ul style="list-style-type: none"> <li>I can solve inequations.<br/>Solve <math>5x + 3 &lt; 12</math>      <math>7x - 2 &gt; 10x + 4</math>      <math>10 - 2(x + 3) &gt; 3(x - 2)</math></li> </ul>                    |   |   |   |

|   |   |   |   |
|---|---|---|---|
| <b>Learning Intention</b>   | I can solve problems using simultaneous linear equations. |   |   |
| <b>Success Criteria</b>   | 😊   | 😐 | 😞 |
| <ul style="list-style-type: none"> <li>I know how to solve systems of equations algebraically using <b>substitution</b> or <b>elimination</b>.<br/>Solve <b>algebraically</b> the system of equations (a) <math>3x + y = 10</math>      (b) <math>3x - 2y = 11</math><br/><math>5x - 2y = 13</math>      <math>2x + 5y = 1</math></li> </ul>  |   |   |   |
| <ul style="list-style-type: none"> <li>I know how to create and solve systems of equations algebraically.<br/>Seats on flights from London to Edinburgh are sold at two prices, £30 and £50.<br/>On one flight a total of 130 seats were sold. Let <math>x</math> be the number of seats sold at £30 and <math>y</math> be the number of seats sold at £50.<br/>(a) Write down an equation in <math>x</math> and <math>y</math> which satisfies the above condition.<br/>The sale of the seats on this flight totalled £6000.<br/>(b) Write down an equation in <math>x</math> and <math>y</math> which satisfies this condition<br/>(c) How many seats were sold at each price?</li> </ul> |   |   |   |



**Learning Intention** I can use and apply the Theorem of Pythagoras.

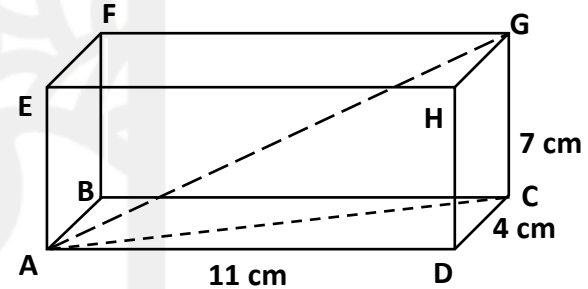
**Success Criteria**



- I can solve problems by applying the Theorem of Pythagoras to 2D and 3D shapes by identifying and drawing a right angled triangle and labelling the sides appropriately.

In the cuboid shown opposite.

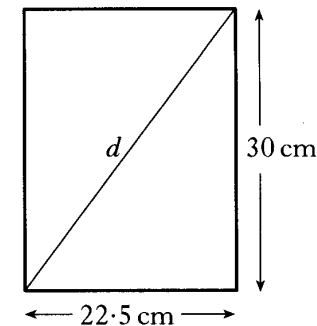
- Calculate the length of the face diagonal AC.
- Hence calculate the length of the space diagonal AG.

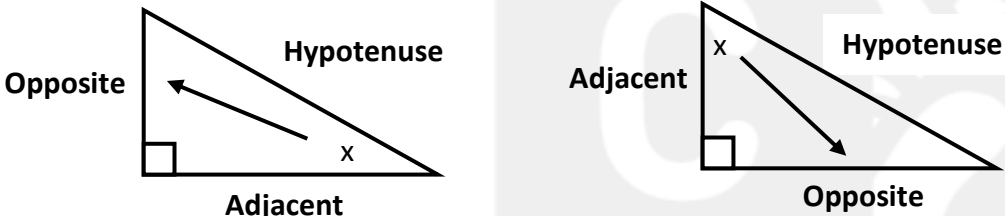
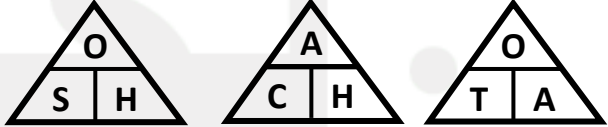
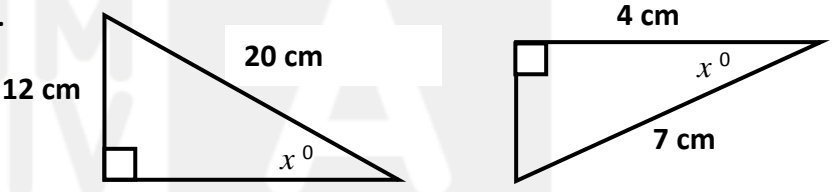



- I know when to use the converse of the Theorem of Pythagoras.

- I know how to use the converse of the Theorem of Pythagoras and can communicate my solution and conclusion correctly.

A rectangular picture frame is to be made. It is 30 centimetres high and 22.5 centimetres wide, as shown. To check that the frame is rectangular, the diagonal,  $d$ , is measured. It is 37.3 centimetres long. Is the frame rectangular?



|   |  |   |   |   |
|---|--|---|---|---|
| <b>Learning Intention</b>   | I can use trigonometry in right angled triangles to calculate an angle or a side.    |   |   |   |
| <b>Success Criteria</b>   |  | ☺ | ☹ | ☹ |
| <ul style="list-style-type: none"> <li>I know that the three sides in a right angled triangle are called the opposite, adjacent and hypotenuse.</li> </ul>      |  |   |   |   |
| <ul style="list-style-type: none"> <li>Given an angle, I can draw and label the 3 sides of a right angled triangle correctly.</li> </ul>                        |    |   |   |   |
| <ul style="list-style-type: none"> <li>I can use “SOH CAH TOA” to determine the correct ratio.</li> </ul>   |   |   |   |   |
| <ul style="list-style-type: none"> <li>I know how to calculate an angle given 2 sides.</li> </ul> <p>Calculate the size of angle <math>x^\circ</math>.</p>      |   |   |   |   |
| <ul style="list-style-type: none"> <li>I know how to calculate a side given an angle and a side.</li> </ul> <p>Calculate the length of side <math>x</math>.</p> |  |   |   |   |

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ACADEMY